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RESEARCH SPOTLIGHT

WisDOT explores higher recycled content in asphalt pavements

More than 90 percent of the 2.6 billion miles of paved U.S. roads are surfaced with asphalt, and many are full-depth asphalt pavements. WisDOT is committed to recycling as much material as possible, which is good for the environment. A reduction in the use of virgin materials will also save money.

But reused binder is harder than virgin binder, and therefore higher levels of reclaimed asphalt pavement (RAP) or recycled asphalt shingles (RAS) must be mixed with softer virgin asphalt to achieve the specified performance grade. The goal has been to find the right blends to meet final binder grade specification requirements and to save contractors from that extra work.

More about WisDOT use of high RAP

MEMBER HIGHLIGHTS

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- TERRA publishes 2014 highlights
- MnDOT/MnROAD–NCAT webinar outlines national pavement preservation study

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PROJECTS AND INITIATIVES

Iowa partnership studying road foundation stabilization technologies

The Iowa Department of Transportation has been working with fellow TERRA member Iowa State University and other research partners to improve roadway construction and performance in Iowa by designing comparative pavement foundation test sections at the Central Iowa Expo Site in Boone, Iowa.

More about Iowa road foundation stabilization research

New software will aid design of concrete pavements in Minnesota

The design of concrete pavements has advanced significantly in the past decade, particularly with recent updates to the American Association of State Highway and Transportation Officials (AASHTO) design guidelines for concrete pavements. To take advantage of these advancements, the Minnesota Department of Transportation (MnDOT) determined that it needed a new design tool tailored to Minnesota's unique conditions.

More about new concrete pavement design software

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- TERRA Pavement Conference and MnROAD workshop set for February 11–12
- CTS Transportation Research Conference scheduled for May 20–21
- NCAT Pavement Test Track Conference, March 3–5
- MAPA upcoming events

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Read more

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RESEARCH SPOTLIGHT

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The Wisconsin Department of Transportation (WisDOT) provided details about this edition's featured research project.

RAP processing and fine and coarse aggregate stockpiles at an asphalt concrete production plant. *(Photo courtesy of FHWA)*

Problem

More than 90 percent of the 2.6 billion miles of paved U.S. roads are surfaced with asphalt, and many are full-depth asphalt pavements. WisDOT is committed to recycling as much material as possible, which is good for the environment. A reduction in the use of virgin materials will also save money.

But reused binder is harder than virgin binder, and therefore higher levels of reclaimed asphalt pavement (RAP) or recycled asphalt shingles (RAS) must be mixed with softer virgin asphalt to achieve the specified performance grade. The goal has been to find the right blends to meet final binder grade specification requirements and to save contractors from that extra work.

Solution

WisDOT and the industry have worked together to outline some of the key issues regarding high levels of recycled materials in pavements and initiate pilot projects to get a level of comfort with the techniques. Efforts include developing a special provision in WisDOT standard specifications that raises the RAP limits for maximum allowable binder replacement from 40 to 50 percent for lower pavement layers and from 25 to 40 percent for upper layers. Other technical details in the provision effectively increase the ceiling on RAS by a few percentage points as well.

(Photo courtesy of MnDOT)

Implementation

WisDOT conducted three pilot projects in 2014 to determine the limits for recycled content and learn which processes model good long-term pavement performance. Based on findings from 2014, WisDOT plans to tweak the special provisions for the 2015 pilot projects as it zeroes in on standard specification language.

Project Partners

Part of the process for making high RAP successful in Wisconsin has been educating the stakeholders involved. In March 2014, representatives from the National Center for Asphalt Technology (NCAT) at Auburn University conducted a two-day educational session in Wisconsin. Participants included WisDOT staff as well as industry representatives.

More Information

- Contact Barry Paye, Materials Lab Supervisor, Technical Services Section, Wisconsin Department of Transportation, Barry.Paye@dot.wi.gov.
- Higher Recycled Pavements are Coming to Wisconsin (Wisconsin Asphalt Pavement Association, May 6, 2014)
- Gearing Up for High-RAP Asphalt (*Wisconsin Asphalt News*, Fall 2013)

Each TERRA member organization has an opportunity to briefly share and showcase a specific research project or initiative in the Member Research Spotlight. Those previously published here remain available through the TERRA E-News archives.

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MEMBER HIGHLIGHTS

News briefs about TERRA and its members

TERRA publishes 2014 highlights

TERRA has published a two-page report highlighting the organization's activities and accomplishments during the past year. The document provides a brief overview of research and implementation, engagement, and communications activities, crediting the committed service of the TERRA General Assembly, coordinated research and implementation activities by members, and thriving ad hoc task forces.

Download *TERRA 2014 Highlights* (674 KB PDF)

MnDOT/MnROAD–NCAT webinar outlines national pavement preservation study

MnROAD and its southern U.S. equivalent, the National Center for Asphalt Technology (NCAT) at Auburn University in Auburn, Alabama, are partnering in a national study to quantify the life-extending benefit of pavement preservation. A joint partnership team webinar held January 8 introduced the two facilities, outlined the national study, and invited state DOTs to participate in the research. Mark McConnell, chief engineer at the Mississippi Department of Transportation and chair of the American Association of State Highway and Transportation Officials (AASHTO) Subcommittee of Maintenance, provided keynote remarks.

Watch the webinar and download presentation slides.

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Iowa partnership studying road foundation stabilization technologies

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High-energy impact roller

The project was constructed from May through July 2012. Sixteen 700-foot-long test sections were constructed on 4.8 miles of roadway to allow long-term performance monitoring, develop local experience with new stiffness measurement technologies to assist with near-term implementation, and increase the range of stabilization technologies to be considered for future pavement foundation design to optimize the pavement system.

The test sections involved using the following stabilization technologies:

- woven and non-woven geosynthetic materials
- triaxial and biaxial geogrids
- 4- and 6-inch geocells with non-woven geosynthetics
- portland cement and fly ash stabilization
- portland cement stabilization of recycled subbase layer
- portland cement and fiber stabilization of the subbase layer with polypropylene fibers and monofilament-polypropylene fibers
- mechanical stabilization
- high-energy impact compaction

Mixing black polypropylene fibers into recycled subbase

The project site consists of 13 roads oriented in the north-south direction and 3 roads oriented in the east-west direction. Reconstruction occurred on all but one road, which had already been paved with hot-mix asphalt. Construction of test sections required removing the existing chip seal surface and subbase, and 6 to 12 inches of subgrade. The subgrade consisted primarily of wet soils.

Sixteen test sections were constructed on the north-south roads that used woven and non-woven geotextiles at subgrade/subbase interfaces; triaxial and biaxial geogrids at subgrade/subbase interfaces; 4- and 6-inch geocells in the subbase layer with non-woven geosynthetics at subgrade/subbase interfaces; portland cement and fly ash stabilization of subgrades; portland cement stabilization of recycled subbase; portland cement and fiber stabilization of recycled subbase with polypropylene fibers and monofilament-polypropylene fibers; mechanical stabilization (mixing subgrade with existing subbase); and high-energy impact compaction. Triaxial and biaxial geogrids were used at subgrade/subbase interfaces at select locations on east-west roads.

Installation of 6-inch geocell over non-woven geosynthetic layer placed on subgrade

All test sections except one were topped with a nominal 6 inches of modified subbase material. Crushed limestone was used in the subbase layer on all north-south roads, and a mixture of recycled concrete and recycled asphalt was used in the subbase layer on all east-west roads. Six test sections consisted of 6 inches of recycled subbase material between the subbase and subgrade layers.

Cost data were compiled from all six contractor-bidder unit prices as requested in the plans and specifications. The project overview tech brief summarizes the combined material and installation costs for the test sections used on the project.

Geosynthetics are at the low end of the cost range, chemical stabilization is in the intermediate range, and special products (fibers and geocell) are at the high-end of the range. The quantities used on this project ranged from about 1,500 ft^2 to 4,500 ft^2.

A tech brief published on the ISU Center for Earthworks Engineering Research project page provides a brief overview of the foundation stabilization technologies used on the project. Individual techs brief provide detailed information for each technology.

Photos courtesy of the ISU Center for Earthworks Engineering Research

Biaxial geogrid placed at the interface of subgrade and limestone base layers

Research partners

- Iowa Department of Transportation
- Central Iowa Expo
- Boone County, Iowa Engineer
- Foth Engineering Alliance
- JB Holland Construction, Inc.
- ISU Center for Earthworks Engineering Research

Related resources:

- Boone County Expo granular road compaction and stabilization project (Phase 1)
- Overview of Foundation Stabilization Technologies (9.9 MB PDF)
- Central Iowa Expo Test Sections - Phase I (9 min, 52 sec video)
- Central Iowa Expo Test Sections - Phase II (5 min, 1 sec video)

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New software will aid design of concrete pavements in Minnesota

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Construction of a concrete test cell at the MnROAD pavement research facility *(Photo courtesy of MnDOT)*

"Prior to this project, MnDOT had designed concrete pavements using a tool based on AASHTO's 1993 design procedure, which has since become outdated," said Lev Khazanovich, associate professor in the Department of Civil, Environmental, and Geo-Engineering and lead researcher. "Our research team set out to create a new tool based on the latest design procedures, and modified to meet MnDOT's needs through the incorporation of local climate and traffic data, along with calibrations specific to Minnesota pavements."

Researchers closely collaborated with MnDOT engineers to determine the design inputs needed to properly account for local conditions and concerns, then built and tested a database of past concrete pavement projects whose characteristics would be used to represent Minnesota pavements for the new software program. Next, researchers developed a Windows-based database and software program known as MnPCC-ME, a design tool for rigid pavements in Minnesota.

According to Khazanovich, the new software has many benefits for MnDOT and Minnesota pavements. "The software is portable, accessible, and produces results instantaneously. In addition, it requires that users modify only critical input parameters, which makes it simple to use. Finally, both the software and database are easily accessed and potentially modified by MnDOT research engineers, which will help ensure the tool remains accurate and current."

With this new tool, Minnesota's state and local engineers will be able to incorporate the latest design procedures when designing their concrete pavements in order to create pavements that are cost-effective, longer-lasting, and better suited to Minnesota conditions.

"This software allows pavement designers to use sophisticated mechanistic-empirical design procedures in a simple format, while still providing robust results," said Luke Johanneck, MnDOT research project engineer.

Full implementation of the software began in November with the release of the new version of MnDOT's pavement design manual.

This article also was published in CTS Catalyst (December 2014).

Related resources:

- Research project page
- MnDOT Pavement Design Manual (1.4MB PDF)

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ANNOUNCEMENTS

Event notices from TERRA, its members, and friends

TERRA Pavement Conference and MnROAD Workshop set for Feb. 11–12

The TERRA Pavement Conference is scheduled for February 12, 2015, at the University of Minnesota Continuing Education and Conference Center in St. Paul, Minnesota. The MnROAD Workshop will be held in conjunction with the conference at the same location from 1:00–4:30 p.m. on February 11.

The TERRA Pavement Conference provides practical information to practitioners and others interested in pavement design, construction, rehabilitation, and maintenance. Session topics this year cover asset management, the new NCAT/MnROAD partnership, freight issues, performance, maintenance, and design and construction.

The 2015 MnROAD Workshop will highlight the benefits of MnROAD Phase Two and showcase the innovations for making roads last longer, perform better, and cost less to build and maintain. The half-day workshop will include presentations focused on implementation by both MnROAD researchers and partnering agencies. The workshop also will include opportunities for one-on-one discussions with researchers and comment on future research plans.

Register now for the 19th Annual TERRA Pavement Conference and the 2015 MnROAD Workshop.

CTS Transportation Research Conference scheduled for May 20–21

The 26th Annual CTS Transportation Research Conference on May 20–21 at the Saint Paul RiverCentre, Saint Paul, Minnesota, will again include an infrastructure track with pavement-related sessions. The University of Minnesota Center for Transportation Studies conference acts as a forum for researchers and practitioners from Minnesota and the Upper Midwest to share their research findings in a variety of transportation-related areas. The conference audience consists of individuals from multiple disciplines and organizations involved in transportation, including policymakers and practitioners from state, regional, and local government; private sector consultants, shippers, carriers, and providers; and faculty, students, and staff from the University of Minnesota and other educational institutions.

NCAT Pavement Test Track Conference

The fifth NCAT Pavement Test Track Conference will be held March 3-5 at the Hotel at Auburn University and Dixon Conference Center in Auburn, Alabama. The scope of this conference will include an overview of the research findings from the 1.7-mile track's 2012-2015 cycle, an overview of preventive maintenance treatments on Lee County Road 159, an update of work at other accelerated loading facilities, and performance presentations on new materials such as warm-mix asphalt, recycled asphalt shingles, and high reclaimed asphalt pavement content mixes. Participants will have an opportunity to tour the Pavement Test Track and Lee County Road 159 while learning how our research translates into implementable findings.

MAPA upcoming events

The Minnesota Asphalt Pavement Association (MAPA) calendar includes this upcoming event:

- 59th Annual Asphalt Contractors' Workshop/ Quality Initiative Workshop, February 19, 2015 Earle Brown Heritage Center, Brooklyn Center, Minnesota

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- Optimal Timing of Preventive Maintenance for Addressing Environmental Aging in Hot-Mix Asphalt Pavements
  (MnDOT, December 2014)
  This report considers the proper timing of preventive maintenance by identifying how environmental aging affects asphalt material properties and preservation treatments.
- Modeling and Monitoring the Long-Term Behavior of Post-Tensioned Concrete Bridges
  (MnDOT, November 2014)
  This report investigates time- and temperature-dependent behavior of post-tensioned concrete bridges.
- Safety Factor Increase to Fatigue Limit States through Shear Spiking for Timber Railroad Bridge Rehabilitation – Phase I
  (Mountains-Plains Consortium, November 2014)
  This report considers the effectiveness of shear spiking—a process for rejuvenating horizontal shear properties by inserting fiberglass pultruded rods through areas of damage on timber railroad bridges – as a low-cost bridge rehabilitation approach.
- Concrete Pavement Mixture Design and Analysis (MDA): Evaluation of the Fresh and Hardened Properties of Concrete Mixtures Containing Hydrophilic and Hydrophobic Types of Permeability-Reducing Admixtures to Develop a Standard Testing Protocol
  (National Concrete Pavement Technology Center, Iowa State University, November 2014)
  This report investigates the fresh and hardened properties of mixtures containing a selection of commercially available permeability-reducing admixtures.
- Bond Behavior of Reinforcing Steel in Ultra-High Performance Concrete
  (FHWA, October 2014)
  The U.S. Federal Highway Administration has released a report that explains the potential of using ultra-high performance concrete-class materials to anchor or lap splice deformed reinforcing bars in field-cast connections as a means to simplify connection details in some prefabricated bridge systems.
- The Use of Polymer Modified Asphalt Binder for High Friction Thin Lift Overlays in Connecticut
  (Connecticut DOT, September 2014)
  This report investigates a roadway's polymer modified high friction wearing course that was designed to improve frictional characteristics of the pavement surface.
- The Use of Synthetic Blended Fibers to Reduce Cracking Risk in High Performance Concrete
  (PACTRANS) September 2014
  This report investigates the use of blended size polypropylene fibers in high performance concrete mixtures, which is a new technique to control early-age cracking.
- Concrete with Steel Furnace Slag and Fractionated Reclaimed Asphalt Pavement
  (Illinois Center for Transportation, September 2014)
  This report evaluates the effects of steel furnace slag and fractionated reclaimed asphalt pavement at 20 and 50 percent replacements of the coarse aggregate in concrete.
- Seismic Performance of Circular Reinforced Concrete Bridge Columns Constructed with Grade 80 Reinforcement
  (PACTRANS, August 2014)
  This report assesses the behavior of circular reinforced-concrete bridge columns constructed with Grade 80 reinforcing steel meeting ASTM A706 specifications subjected to reversed cyclic lateral loading.
- Bridge Condition Assessment and Load Rating using Dynamic Response
  (Ohio Department of Transportation, July 2014)
  This report describes a method for the overall condition assessment and load rating of prestressed box beam bridges based on their dynamic response collected through wireless sensor networks.
- Trinidad Lake Asphalt Overlay Performance Final Report

(Washington Department of Transportation, July 2014)
This report evaluates a hot mix asphalt overlay that was designed to help resist the stresses of a bridge's orthotropic deck.

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